

We Claim:

1. A bridge circuit for switching power to one or more transformers, the bridge
10 circuit comprising:

a plurality of multiple gate pairs, each gate pair having two gates arranged in series,
wherein opposite ends of windings of each of the three-phase transformers are connected
between the gates of separate gate pairs in a corresponding one of the bridges.

15 2. The bridge circuit according to claim 1, wherein the plurality of gate pairs
comprises six gates arranged in three series-connected two-gate pairs.

20 3. The bridge circuit of claim 1, further comprising a plurality of antiparallel
diodes, each antiparallel diode being fitted to one of the gates to allow shorting current flow
through one or more of the windings of a shorted transformer.

4. A control circuit for controlling the amount, duration, and polarity of DC
voltage supplied to each of a plurality of transformers of a step wave power converter, the
control circuit comprising:

25 management circuitry configured to vary a number of steps that each of a plurality of
independent power sources contribute to the step wave AC output according to an amount of
energy available from each of the different independent power sources.

30 5. The control circuit according to claim 4, wherein the plurality of transformers
comprises a plurality of three-phase transformers, each transformer arranged in a delta-wye
configuration and wherein the control circuit further comprises:

a phase management controller for constructively using phase differences between
delta configured windings and wye configured windings of the transformers to produce
additional steps in the step wave AC output.

35 6. A method for enhancing a three-phase step wave AC output from a three-
phase step wave power converter having a plurality of three-phase transformers arranged with

5 delta-wye winding configurations, comprising:

increasing the number of steps in the three-phase step wave AC output by controlling timing and sequencing of the DC voltage inputs into the delta-wye three-phase transformers to take advantage of inherent properties of the delta-wye transformation.

10 7. A method according to claim 6, wherein each of a plurality of DC power sources is provided with cut-off gates to allow it to be selectively disconnected from the system according to performance of the respective DC power source.

15 8. A cross-tie circuit arranged between two or more bridge circuits, each bridge circuit being connected to a separate transformer, to allow a single power source to supply power to two or more transformers.

9. A cross-tie circuit according to claim 8, wherein at least one power source is provided with a bypass switch to allow it to be readily disconnected from the system.

20 10. An isolation circuit for isolating the DC bus from at least one of the power sources, comprising:

a transformer configured to receive DC voltage input from a DC bus, the DC bus configured to receive power from one or more power sources, said transformer being configured to supply a step for a step wave AC output; and

25 wherein at least one of the power sources is an input power grid and wherein the isolation circuit isolates the DC bus from the input power grid to prevent backfeed to the grid from the DC bus.

30 11. The isolation circuit according to claim 10, wherein at least one of the power sources supplies a variable frequency power input to the DC bus.

12. A backup power system, comprising:

35 one or more backup power sources connected to a load through a step wave power converter; and

wherein said step wave power converter is configured to selectively receive and

5 condition power from a selected one or more of the backup power sources and to supply user grade AC electricity to the load.

13. A method for conditioning an AC power supply, comprising:
supplying a DC voltage or regulated AC voltage input to a step wave power converter;
10 transforming the DC voltage or regulated AC voltage input into a plurality of steps of the step wave AC waveform; and
pulse-width modulating the DC voltage or regulated AC voltage input while the input voltage is being transformed into a step of the output AC waveform.

15 14. A method of conditioning an AC power supply according to claim 13, wherein:

supplying a DC voltage or regulated AC voltage input comprises supplying a plurality of DC voltage and/or regulated AC voltage inputs to a plurality of transformers; and wherein pulse-width modulating the voltage input comprises pulse-width modulating the voltage input into a selected one of the transformers while holding the voltage input into another one of the transformers in a constant on or off state, in order to fine-tune the step wave AC output in substantial conformity with an ideal AC sine wave.